Project Summary

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Development of Threshold and Ground Displacement Charts for Liquefaction-Induced Lateral Spreading Using Cone-Penetration Testing

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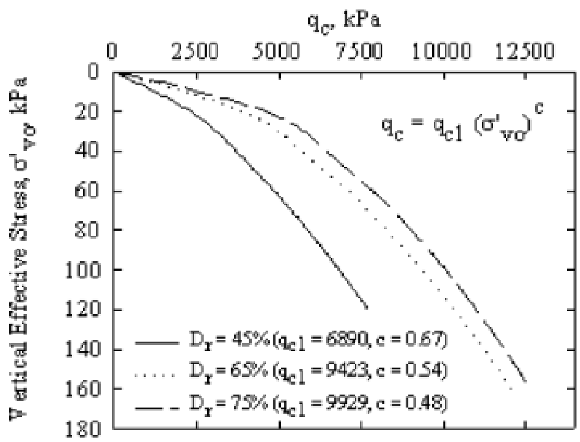
Problem Statement: Liquefaction of loose, water-saturated sands and other granular soils due to earthquake shaking is a major cause of damage to and destruction of constructed facilities. One of the major liquefaction-induced types of ground failure is lateral spreading of mildly sloping ground.



Objectives: Evaluate permanent lateral ground deformation (D_H) due to lateral spreading, using the widely applied *in situ* static cone-penetration testing (CPT) technique. Correlate lateral spreading D_H measurements with the CPT in centrifuge model tests of liquefaction-induced lateral spreading.

Scope: After proper verification against the available empirical and case-history information related to both CPT and D_H in the field, provide the basis for reliable CPT-based charts to predict D_H in the field for given ground slope, soil conditions, and strong motion input. Also, these charts provide further clarification of the threshold combinations of CPT value, soil depth, ground slope, and strong motion input for which D_H becomes negligible even if the soil liquefies. These results should improve significantly our capability to evaluate earthquake hazard, including their use in efficiently mapping and predicting lateral-spreading earthquake effects over extended areas.

Approach: This research effort employs physical prototype modeling of both lateral-spreading and static-cone penetration using the centrifuge facility at RPI. In the research approach taken, the tip resistance (q_c) from static CPT tests in sands is modeled in the centrifuge and correlated directly with lateral displacement D_H caused by liquefaction-induced lateral spreading due to strong ground shaking, measured also in centrifuge tests. This will then be combined with field data to produce charts relating q_c and D_H, to be used in the field: (1) to predict D_H for given ground shaking and site conditions; and (2) to establish threshold combinations of parameters for which the point resistance, q_c, is deemed high enough so that no significant D_H is predicted, even if the site liquefies.